Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

SHOUT
SHARE
IT

BULLETIN OF THE
U.S. DEPARTMENT OF AGRICULTURE

No. 38

Contribution from the Bureau of Plant Industry, Wm. A. Taylor, Chief.
November 19, 1913.

SEED SELECTION OF EGYPTIAN COTTON.

By Thomas H. Kearney,
Physiologist, Alkali and Drought Resistant Plant Investigations.

IMPORTANCE OF KEEPING THE STOCK PURE.

While questions of picking, ginning, and marketing are doubtless uppermost in the minds of most growers of Egyptian cotton in the Salt River Valley, they should not lose sight of the fact that the industry can not be permanently profitable unless a supply of pure seed is maintained. Cotton, like corn, is open fertilized, and the pollen is readily carried from one plant to another by bees and other insects. Unless due precautions are taken to prevent crossing, the varieties soon become mixed and deterioration is rapid. Moreover, the most carefully selected stock, even when completely isolated from other cotton, produces occasional "off-type" plants which are inferior to the average in productiveness and in the quality of the lint. Such plants, unless removed, will soon contaminate the entire stock and rapid deterioration will follow. Measures to prevent this are indispensable if the industry is to be maintained. The highest obtainable price for Egyptian cotton depends upon its uniformity in length, strength, and other qualities. Uniform land, proper irrigation, and good ginning all contribute to make the product uniform, but these are of little avail if the seed is allowed to run out or to become mixed.

Deterioration of the stock is inevitable if more than one type of cotton is grown in a community. This will come about not only by the crossing of the plants in the fields but by mixing the seed in ginning and handling. The experience of older cotton-growing communities has proved this time and again.

The Department of Agriculture, after much consideration of what type of cotton would be likely in the long run to give the most profitable returns in the Salt River Valley, distributed among the farmers seed of a carefully selected, uniform variety of Egyptian cotton which has been developed as a result of 10 years of plant-breeding work in Arizona. This variety has been thoroughly tested, both in

the field and in the factory. It yields heavily and produces fiber which manufacturers of long-staple cottons have found to be very satisfactory in spinning quality. The experience of those who planted this cotton last year indicates that it can be profitably grown in the Salt River Valley.

There is at present no evidence that any other cotton will be more profitable in this district. If in the future, evidence should be forthcoming that a change to some other type would be advantageous, the change should be made at once and by the community as a whole. Meantime the introduction of other sorts by individual growers should be discouraged, as it would surely spell disaster to a promising industry.

THE EGYPTIAN TYPE OF COTTON.

Egyptian cotton is a distinct type which bears a resemblance to the American Sea Island, yet it is quite different from the latter. Its origin is obscure, although it is generally believed to be partly of Sea Island ancestry. The fiber of Egyptian cotton is especially used in manufacturing goods in which great strength is required, such as sewing thread, automobile-tire fabrics, the better quality of hosiery, etc.; also the finer grades of cotton cloth, for the production of which long and fine fiber is demanded.

The history of cotton growing in Egypt has been marked by the appearance of one variety after another. Each of these gave very satisfactory results at first, but soon "ran out," owing to the failure of the growers to keep their seed pure. About 30 years ago the Mit Afifi variety came into prominence, and in 1912 this variety still constituted 25 per cent of the entire crop of the country. Its lint is of medium length ($1\frac{1}{4}$ to $1\frac{3}{8}$ inches) and is distinguished by its deep buff color. The Mit Afifi variety is often referred to by the trade name, "Brown Egyptian." In the last 10 years it has deteriorated rapidly and no longer holds its former high place in the estimation of cotton spinners. More recently, longer linted varieties, of which Jannovitch, Nubari, and Sakellaridis are the most important, have been successively developed. Of these, Jannovitch and Nubari have already begun to run out. Sakellaridis, on the other hand, is of such recent origin that there has been less opportunity for mixing and deterioration.

Each of these varieties apparently originated suddenly with a single very distinct plant growing in a field of some older variety. The origin of a variety in this manner is termed by plant breeders "mutation," or "sporting," and the new type thus developed is usually so different from the parent variety that no relationship would be suspected if the origin were not known. Mutations are

usually strongly prepotent; that is to say, they produce very uniform progeny.

The origin of new varieties by mutation must not be confused with the improvement of an existing variety by selection. The so-called Assil cotton, which is attracting much attention in Egypt, is apparently an example of the latter process, having been developed by simply selecting the plants of Mit Afifi having the most abundant lint. In all essential characters Assil is still Mit Afifi, although constituting a superior strain of that variety. On the other hand, Jannovitch, Nubari, and Sakellaridis are totally distinct varieties, easily distinguishable by the characters of the plants and the fiber.

Until quite lately very little was done in Egypt to keep the different varieties from intercrossing. In addition to the presence of a half dozen commercial varieties, the country is full of an inferior type known as weed cotton, or "Hindi," producing scanty, weak, short fiber, which is white, like American Upland, rather than buff or cream colored, as in most Egyptian varieties. The Hindi plants, unless removed from the fields before they begin to blossom, readily cross with the Egyptian, and the result is a multitude of worthless and often nearly sterile hybrids.

The recently established Egyptian department of agriculture is striving to induce the growers to practice seed selection on their farms, but thus far the only remedy for the bad effects of all this mixing has been to sort the cotton by hand, picking out the masses of white Hindi fiber. This practice is rendered economically possible only by the cheapness of labor in Egypt.

PLANT-BREEDING WORK IN ARIZONA.

Twelve years ago the United States Department of Agriculture imported seed of the principal Egyptian varieties of cotton and began testing them in Arizona. The Mit Afifi having given better results than any other variety then at hand, the work was continued with this type alone. By dint of selection for five or six years some progress was made in increasing the yield and earliness of the plants and the abundance, length, and strength of the fiber. Yet until 1908 the results were not very encouraging. In that year the appearance of a superior type, very distinct from Mit Afifi in all of its characters, offered a promising basis for the establishment of Egyptian cotton in Arizona.

This new type, distinguished from Mit Afifi by its relatively large bolls and long, cream-colored fiber, is the Yuma variety, which is now being grown in the Salt River Valley. It resembles the Nubari variety, which appeared in Egypt at about the same time, in the shape of the leaves, bracts, and bolls, but is superior in the staple and

quality of the fiber, which more nearly resembles that of the Egyptian Jannovitch. Other promising types have since been developed in Arizona by the Department of Agriculture and are being tested in comparison with the Yuma variety.

The methods used in this plant-breeding work are simple. In the first planting of imported seed every individual plant was examined. The productiveness, earliness, habit of growth, and size of the bolls were noted, and the lint was combed out on the seed, measured, and pulled to test its strength. The best individuals were then selected and the seed from each was saved separately. In the following year the seed from each selection was planted in a "progeny row," the rows being side by side and of equal length. It now became possible to compare the different selections on the basis of the uniformity and desirability of their progeny and to discard rows in which the plants showed much variation or were for the most part inferior. All plants in the superior rows were then compared, the best individuals were selected, and their seed was planted in progeny rows the following spring.

This procedure has been repeated each year. When a strikingly superior progeny row, such as that from which the Yuma variety originated, is discovered, an isolated field is planted with the seed and the inferior and off-type plants are rogued out before they come into blossom. By repeating this process of roguing several years in succession a high degree of uniformity is attained.

HOW THE FARMER MAY KEEP HIS SEED PURE.

Thus far we have been discussing the work of the plant breeder in producing new strains and varieties. No less important, however, is the maintenance of a variety after it has been developed, and here the cooperation of the grower is necessary. Take, for example, the Yuma variety, which is now being grown in the Salt River Valley. The grower should become thoroughly acquainted with the appearance of the plants, so that he may learn to recognize the characters of the leaves, bracts, and bolls which belong to typical Yuma cotton. This can scarcely be done by reading a printed description, but when the characters have been pointed out by a person who is familiar with them they are not likely to be forgotten. With this knowledge well in mind, the farmer should then go over the field from which he expects to save seed for next year's planting and should rogue out every plant which strikes him as not typical. The work had better be done before the plants begin to blossom, so as to avoid contamination of the good plants with pollen from the bad ones. A second roguing when the bolls begin to set is also advisable in order to remove any untypical plants that may have been overlooked the first

time, as well as the plants which appear less productive than the average. If this procedure is generally followed, especially by those who expect to sell seed for planting, it is probable that the stock can be grown for many years without deterioration. Its length of life will depend chiefly upon the skill and thoroughness with which the roguing is done. Roguing the fields will be found advantageous, even if none of the seed is to be used for future planting, for a much more uniform crop of fiber can be obtained if the undesirable plants are removed.

In addition to removing the very inferior plants from his fields, every cotton grower should seek to improve his seed by the selection of the best plants. He should go over the field when the bolls begin to open and mark those plants which are most fruitful and have the largest bolls and the longest, strongest, and most abundant fiber. The seed cotton from these plants should be gathered before each general picking and ginned with every precaution to prevent contamination. The seed thus obtained should be planted in a special plat for increase, and in this way a large supply of extra good seed will be available for general field planting the second year after the selections are made. By systematically following this method of "bulk selection" the grower can greatly improve both the quantity and the quality of his product.

WHAT THE GROWERS' ASSOCIATIONS SHOULD UNDERTAKE.

While every farmer should do his best to keep his seed pure, it is not likely that all will have the time or the training requisite to do this thoroughly. Consequently, the stock is likely to fall off gradually unless special provision is made by the community for a supply of pure seed. The associations should pick out a few of the best growers who have uniform land and are sufficiently skillful in managing irrigation and cultivation to keep the plants in an even condition of growth throughout the field. Trained persons who know how to recognize at a glance the off-type and inferior plants should be employed to visit these fields frequently and to aid the grower in roguing them thoroughly at the right time. The associations should purchase the seed from these fields at a price commensurate with the extra work involved for sale to their members at a price to be determined by the cost of the purchase and handling and the pay of the experts employed to secure proper roguing. Thus, a constant supply of the purest possible seed would be available in the valley to replace the gradually deteriorating seed of the majority of growers.

Experience has shown that one of the chief causes of the deterioration of cotton varieties is mixing at the gins. No amount of selection and roguing in the field will insure pure seed unless every precaution is taken to prevent subsequent mixing. The associations should there-

fore see to it that either certain gins are set aside solely for ginning the cotton from the rogued fields or else that the gins are thoroughly cleaned before this special seed cotton is run through. All sacks, bins, wagons, etc., used in handling and storing the select seed, both before and after ginning, should be carefully inspected in order to make sure that no other seed or seed cotton is present. Finally, the greatest care should be taken to mark the sacks or bins containing the selected seed, so that mixing can not take place. The packages in which this seed is sent out to growers should be so marked that there can be no uncertainty about the seed which they contain.

WHAT THE DEPARTMENT OF AGRICULTURE CAN DO.

The Department of Agriculture can cooperate with the associations of growers by instructing the persons who may be selected to supervise the roguing in regard to the type which is to be preserved. The department recognizes that in the present state of the industry the growers can not be expected to possess such knowledge, but it is expected that many of them will endeavor to familiarize themselves with the points involved, so that the associations will soon be able to carry the work along on their own initiative.

At the cooperative experimental garden at Sacaton plant-breeding work will be continued, with a view to developing still better varieties of Egyptian cotton.

Other sorts of cotton which may be suggested as likely to be more profitable will be tested in comparison with the variety now grown, under such conditions as to preclude any danger of contaminating seed which is intended for distribution to farmers. If this work should result in demonstrating that it will be advantageous for the growers to replace the present stock with some other, steps will be taken to supply them, through the associations, with sufficient seed to enable the entire community to make the change at one time. In short, no effort will be spared to aid the Salt River Valley in gaining a reputation for the excellence of its long-staple cotton.

SUMMARY.

Egyptian cotton is a special type, related to Sea Island, but very distinct. The fiber is especially used in the manufacture of fine cloths and of goods in which strength and durability are essential, such as sewing thread, hosiery, automobile-tire fabrics, etc.

Numerous varieties have been successively developed in Egypt. Each of these has apparently originated as a mutation, or "sport," quite different from the parent stock and producing a very uniform progeny. The varieties rapidly deteriorate in Egypt, however, as a result of crossing with one another and with the Hindi, or weed cotton, which is present in all parts of the country.

The Yuma variety, which is now being grown in the Salt River Valley, originated in the course of plant-breeding work by the United States Department of Agriculture. It appeared suddenly among selections of the Mit Afifi variety, but is totally distinct from that variety in all of its characters and has shown from the first a strong tendency to produce uniform progeny. It is therefore to be regarded as a mutation.

Only one variety of cotton should be grown in a community. Otherwise, there is sure to be crossing of the plants in the fields and mixing of the seed at the gins. The result will be lack of uniformity in the fiber produced and it will be found impossible to obtain the high prices which manufacturers of fine cottons are willing to pay for a uniform product.

All cotton varieties, even when grown from carefully selected seed and planted where crossing with other varieties is impossible, produce a certain number of off-type and inferior plants, which can be recognized by the characters of their branches, leaves, and bracts. Such plants should be carefully rogued out in order to obtain pure seed for planting and thus maintain the uniformity of the stock. Roguing should be done before the blossoms appear, in order to prevent the crossing of the inferior plants with the good ones.

The grower should select each year a few of the best plants in his field, saving the seed from them separately and planting it in a special plat for increase. Farmers who systematically follow this plan will soon gain a reputation for the production of superior cotton.

The associations of cotton growers in the Salt River Valley should arrange each season with some of the best farmers who have uniform land to have their fields rogued, in order that a supply of pure seed shall be available for next year's planting. Great care should be taken to have this superior seed ginned and stored under such conditions as to prevent its getting mixed with other seed.

LITERATURE WHICH MAY BE CONSULTED.

Kearney, T. H., and Peterson, W. A. Egyptian cotton in the Southwestern United States. U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 128, 1908.

Gives an account of the crop in Egypt, of the special uses of this type of cotton, and of the beginning of the plant-breeding work in the United States.

Kearney, T. H., and Peterson, W. A. Experiments with Egyptian cotton in 1908. U. S. Department of Agriculture, Bureau of Plant Industry, Circular 29, 1909.

A report of progress in the plant-breeding work.

Cook, O. F., McLachlan, A., and Meade, R. M. A study of diversity in Egyptian cotton. U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 156, 1909.

Describes the different kinds of abnormal plants occurring in fields of Egyptian cotton which became mixed through crossing with other types.

KEARNEY, T. H. Breeding new types of Egyptian cotton. U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 200, 1910.

Describes in detail the Yuma variety and other types developed and the methods used in the breeding work.

COOK, O. F. Cotton selection on the farm by the characters of the stalks, leaves, and bolls. U. S. Department of Agriculture, Bureau of Plant Industry, Circular 66, 1910.

Points out methods by which growers may maintain the purity of their seed.

COOK, O. F. Hindi cotton in Egypt. U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 210, 1911.

Discusses the contamination in Egyptian fields due to the presence of "weed cotton," and conveys a warning to American growers of the necessity of safeguarding the purity of their stocks.

MCLACHLAN, A. The branching habits of Egyptian cotton. U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 249, 1912.

Describes the character of the branches in this type of cotton and points out the relation of these characters to productiveness.

KEARNEY, T. H. Fiber from different pickings of Egyptian cotton. U. S. Department of Agriculture, Bureau of Plant Industry, Circular 110, p. 37–39, 1913.

Shows that the fiber may differ considerably in the different pickings and that this should be taken into account in grading. Suggests that seed from the earliest and the latest picking may not be desirable for planting.

COOK, O. F. Heredity and cotton breeding. U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 256, 1913.

Shows how characters are coordinated and the application of this fact in cotton breeding.

ADDITIONAL COPIES of this publication may be procured from the SUPERINTENDENT OF DOCUMENTS, Government Printing Office, Washington, D. C., at 5 cents per copy

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1913